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| 10/595,523 | 04/25/2006 | Masahiro Nakayama | 039.0071 | 2166 |

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| EXAMINER | |
|---|---|
| LEE, JAE | |

| ART UNIT | PAPER NUMBER |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/595,523 | NAKAYAMA ET AL. | |
| | Examiner | Art Unit | |
| | Jae Lee | 2823 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *06 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. **Claims 1,2** are rejected under 35 U.S.C. 102(b) as being anticipated by Morishita (Pub No. US 2002/0121863 A1, hereinafter Morishita).

With regards to **claim 1**, Morishita teaches a gallium-nitride semiconductor substrate, characterized in that metal contamination on the substrate surface is 10 x $10^{11}$ atoms/$cm^2$ or less (see Morishita, GaN substrate has no manmade element metals such as europium).

With regards to **claim 2**, Morishita teaches a gallium-nitride semiconductor substrate, characterized in that metal contamination on the substrate surface is 5 x $10^{11}$ atoms/$cm^2$ or less (see Morishita, GaN substrate has no manmade element metals such as europium).

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. **Claim 3** is rejected under 35 U.S.C. 103(a) as being unpatentable over Toda et al. (USP# 6,791,120 B2, hereinafter Toda et al.).

With regards to **claim 3**, Toda et al. teaches a method of processing a gallium-nitride semiconductor substrate having a complex of faces in which Ga is exposed and faces in which N is exposed, the method comprising:

Polishing the substrate with an abrasive embedded into a metallic platen, thereby leaving a process-transformed layer on the substrate (see col. 8, lines 43,44; col. 9, lines 4-5);

Reactive-ion etching the substrate using a halogen plasma to remove the process-transformed layer (see col. 9, lines 29-45); and

Wet etching the reactive-ion etched substrate, by means of an etchant that is not selective for either the Ga or the N faces of the substrate, yet does have metal etching capability, thereby to remove contaminant metal produced by said reactive-ion etching

(see col. 8, lines 32-34, alumina used which has aluminum metal will contaminate the GaN substrate; see col. 9, lines 45-51).

Toda et al., however, does not teach the oxidation-reduction potential of more than 1.2 V.

In the same field of endeavor, it would have been obvious to one of ordinary skill to determine the optimum oxidation-reduction potential (see *In re Aller, Lacey, and Hall* (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical (see *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990)).

4. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over Suguro et al. (Pub No. US 2004/0266214 A1, hereinafter Suguro et al.).

With regards to **claim 4**, Suguro et al. teaches a method of processing a gallium-nitride semiconductor substrate having a complex of faces in which Ga is exposed and faces in which N is exposed, the method comprising at least the step of:

Wet etching the substrate by means of an etchant that is $H_2So_4 + H_2O_2$ (see ¶90, 99, line 9).

Suguro et al., however, does not teach having an oxidation-reduction potential of more than 1.2 V.

In the same field of endeavor, it would have been obvious to one of ordinary skill to determine the optimum oxidation-reduction potential (see *In re Aller, Lacey, and Hall* (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical (see *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990)).

5. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Toda et al. as applied to **claim 3** above, and further in view of Flynn et al. (Pub No. USD 2003/0213964 A1, hereinafter Flynn et al.).

With regards to **claim 5**, Toda et al. teaches the limitations of **claim 3** for the reasons above.

Toda et al., however, does not teach the method of processing a gallium-nitride semiconductor substrate as set forth in **claim 3**, characterized in that a wash for taking off organic matter by means of an organic solvent, and a wash by means of an alkaline solution in order to take off nonmetal contaminants are carried out either before or after the wet etching.

In the same field of endeavor, Flynn et al. teaches a wash which contains an acetone wash as well as a $NH_4OH$ wash in order to further clean off impurities or surface contaminants (see ¶220, ¶224).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to further clean out surface contaminants or impurities using an organic wash and an alkali wash as have been demonstrated and made known by Flynn et al.

6. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Toda et al. as applied to **claim 4** above, and further in view of Flynn et al.

With regards to **claim 6**, Suguro et al. teaches the limitations of **claim 4** for the reasons above.

Suguro et al., however, does not teach the method of processing a gallium-nitride semiconductor substrate as set forth in **claim 4**, characterized in that a wash for taking off organic matter by means of an organic solvent, and a wash by means of an alkaline solution in order to take off nonmetal contaminants are carried out either before or after the wet etching.

In the same field of endeavor, Flynn et al. teaches a wash which contains an acetone wash as well as a $NH_4OH$ wash in order to further clean off impurities or surface contaminants (see ¶220, ¶224).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to further clean out surface contaminants or

impurities using an organic wash and an alkali wash as have been demonstrated and made known by Flynn et al.

7. **Claims 7,8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Toda et al. as applied to **claim 3** above.

With regards to **claim 7,8**, Toda et al. teaches the limitations of **claim 3** for the reasons above.

Toda et al., however, does not teach having a surface metal-contamination density of not more than $10 \times 10^{11}$ atoms/cm$^2$ or $5 \times 10^{11}$ atoms/cm$^2$.

In the same field of endeavor, it would have been obvious to one of ordinary skill to determine the optimum surface metal-contamination density (see *In re Aller, Lacey, and Hall* (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical (see *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990)).

8. **Claims 9,10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Suguro et al. as applied to **claim 4** above.

With regards to **claims 9,10**, Suguro et al. teaches the limitations of **claim 4** for the reasons above.

Suguro et al., however, does not teach having a surface metal-contamination density of not more than $10 \times 10^{11}$ atoms/cm$^2$ or $5 \times 10^{11}$ atoms/cm$^2$.

In the same field of endeavor, it would have been obvious to one of ordinary skill to determine the optimum surface metal-contamination density (see *In re Aller, Lacey, and Hall* (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical (see *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990)).

## *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jae Lee whose telephone number is 571-270-1224. The examiner can normally be reached on Monday - Friday, 7:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JML

LEX MALSAWMA
PRIMARY PATENT EXAMINER